

Diagnostic Quality of Endoscopic Images in a Telemedicine Application

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Endoscopy is a medical procedure predicated on the ability of technology to transmit images. Its potential as a component of any telemedicine system is immediately apparent, but validation of the quality of the tele-endoscopy image is essential. However, validation is complicated by the normal variability of concordance among gastroenterologists in reading endoscopic images.^{1,2}

Tele-endoscopy requires that the image seen by the consulting endoscopist be virtually identical to that seen by the physician performing the procedure at the remote site. Critical areas center on image quality with minimal motion artifact. Excessive motion could impair the ability to view both normal and abnormal mucosa, obscuring mucosal detail which could indicate subtle changes in disease states. Even prominent lesions could potentially be affected, resulting in inaccurate or indefinite diagnoses. The normal constant movement along the upper or lower GI tracts during an endoscopic procedure could also introduce motion artifacts, again inhibiting accurate diagnoses.

For the purposes of this study, existing video-conferencing equipment within the academic medical center was used. The equipment consisted of desktop computers with high resolution color monitors and the images were transmitted over digital phone lines (ISDN) at 384 kbps. Endoscopists from the Departments of Medicine and Surgery participated in the study, with one performing the procedure and one viewing the procedure remotely. Discussion between the primary endoscopist and the observer was limited to a recitation of presenting history prior to beginning the procedure.

Both physicians recorded information onto an evaluation form asking for specifics of the procedure, identity of both physicians involved, a synopsis of patient history, a diagnosis, if possible, and the degree of certainty utilizing a linear analog scale. The observing physician was also asked to record on a visual analog scale perceptions of overall video quality and information regarding mucosal and anatomic detail.

Twenty-three cases were viewed and classified into one of three categories, complete diagnostic agreement, clinically insignificant diagnostic disagreement, or clinically significant diagnostic disagreement. Clinically insignificant diagnostic disagreement was defined as disagreement between the primary endoscopist and the observer which would not have an impact on therapeutic or prognostic decisions.

For all of the cases, clinically significant agreement (complete agreement and clinically insignificant disagreement) was 100%. Five cases were classed as clinically insignificant disagreement, primarily due to uncertainty on the part of one of the endoscopists. On two of the twenty-three cases, image quality was noted as less than optimal. Using a visual analog scale, certainty of diagnosis was 10.1% lower for tele-endoscopy ($p=0.007$) in cases with clinically insignificant disagreement. However, certainty using tele-endoscopy did not differ significantly for cases with complete diagnostic agreement.

Movement artifact using telemedicine qualitatively differed from that seen on the primary image, resulting in tele-endoscopy visual analog scores being 17.6% lower for mucosal detail ($p<0.001$), 11.6% lower for anatomic detail ($p<0.001$), and 13.7% lower for overall video quality ($p<0.001$). The endoscopists felt that the still image would be superior in several cases.

Given the lack of clinically significant disagreement in diagnoses, the differences in image quality may not be of clinical importance. Viewing of additional cases will help clarify the relationship between image quality and diagnostic agreement.

References

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